

# Radiation Research at the Idaho Accelerator Center

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**Frank Harmon,  
Idaho Accelerator Center  
Idaho State University**

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# Idaho Accelerator Center

- Develop applications of radiation and nuclear science and accelerator technology.
- Provide a resource for university, industrial & governmental organizations involved in research and development that requires the use of nuclear science.
- Educate and train next generation of nuclear scientists and engineers.



# What We Do

## Basic nuclear measurements and radiation effects

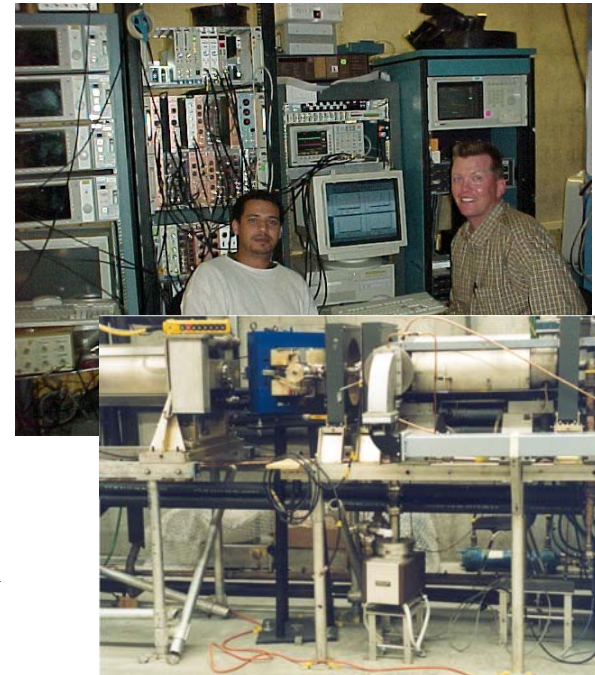
- Instrument testing for DOE SPSS programs
- Photo-nuclear research for neutron sources and other applications
- Nuclear and space radiation effects

## Biomedical radiation effects

- Dose and dose rate effects on biological systems

## Non-destructive evaluation, assay, elemental analysis and imaging

- Compton back-scatter photons for materials, biological and industrial research and application
- Accelerator based NDA/NDE development
- Transmutation for trace element nuclide detection



# Facilities

## Laboratories

- Highly shielded laboratories designed for electron LINAC accelerators and accelerator driven neutron sources
- Electronics and mechanical shops
- 14,000 sq. ft. new space under construction- completion Fall '03 to house ISIS I & II, linac neutron source, IAC Business Development Facility
- Radiographic imaging laboratory



# Accelerators

## Van de Graaffs

- 2MV Positive Ion
- 2MV Positive Ion/Electron

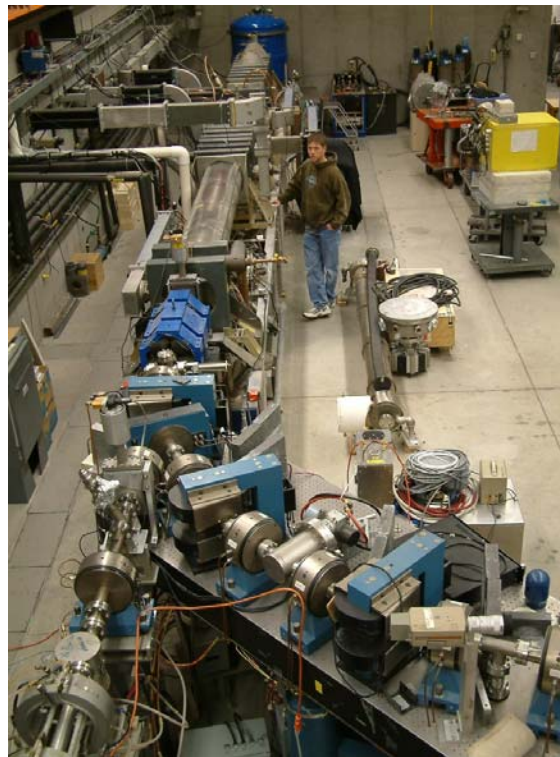
## Tandem

- ~1 MV Terminal

## S Band Standing Wave Linacs

- 2 MeV
- 4 MeV
- 6 MeV
- 18 MeV
- 22 MeV

## L Band Traveling Wave Linac



## Various X-Ray Generators

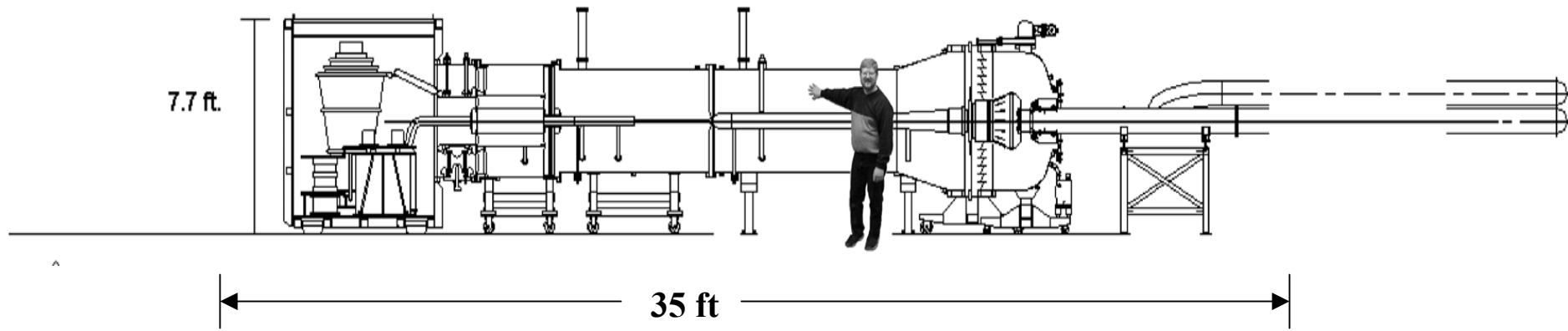
- 75-450 kV

## Storage

- 10 MeV 10KA Pulse Power Electron Accelerator (ISIS I & II)
- 20MeV P Band, 3MW e linac
- 25 MeV S Band TW e linac
- 1.5 MeV RFQ

# ISIS I (Idaho State Induction Acceleration System I)

This accelerator, formerly known as SLIA (Spiral Line Induction Accelerator), was donated to Idaho State University/IAC by Titan Systems Corporation, San Leandro CA, October 2001.

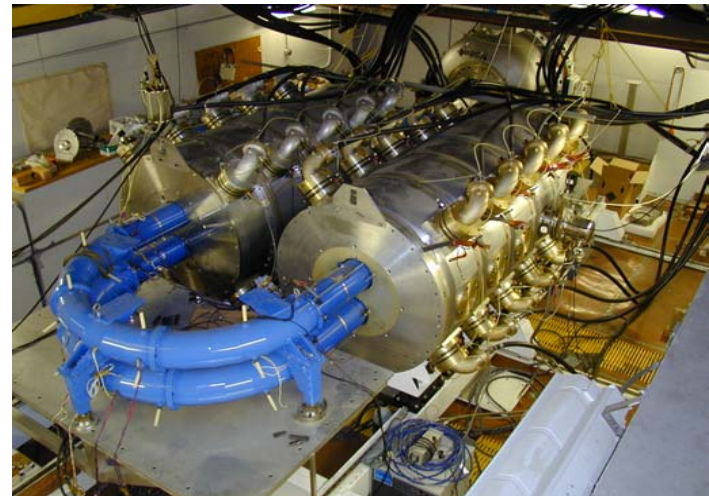


**3.5 MeV Electron Beam**

**$I_{\text{beam}} \approx 15 \text{ kA}$**

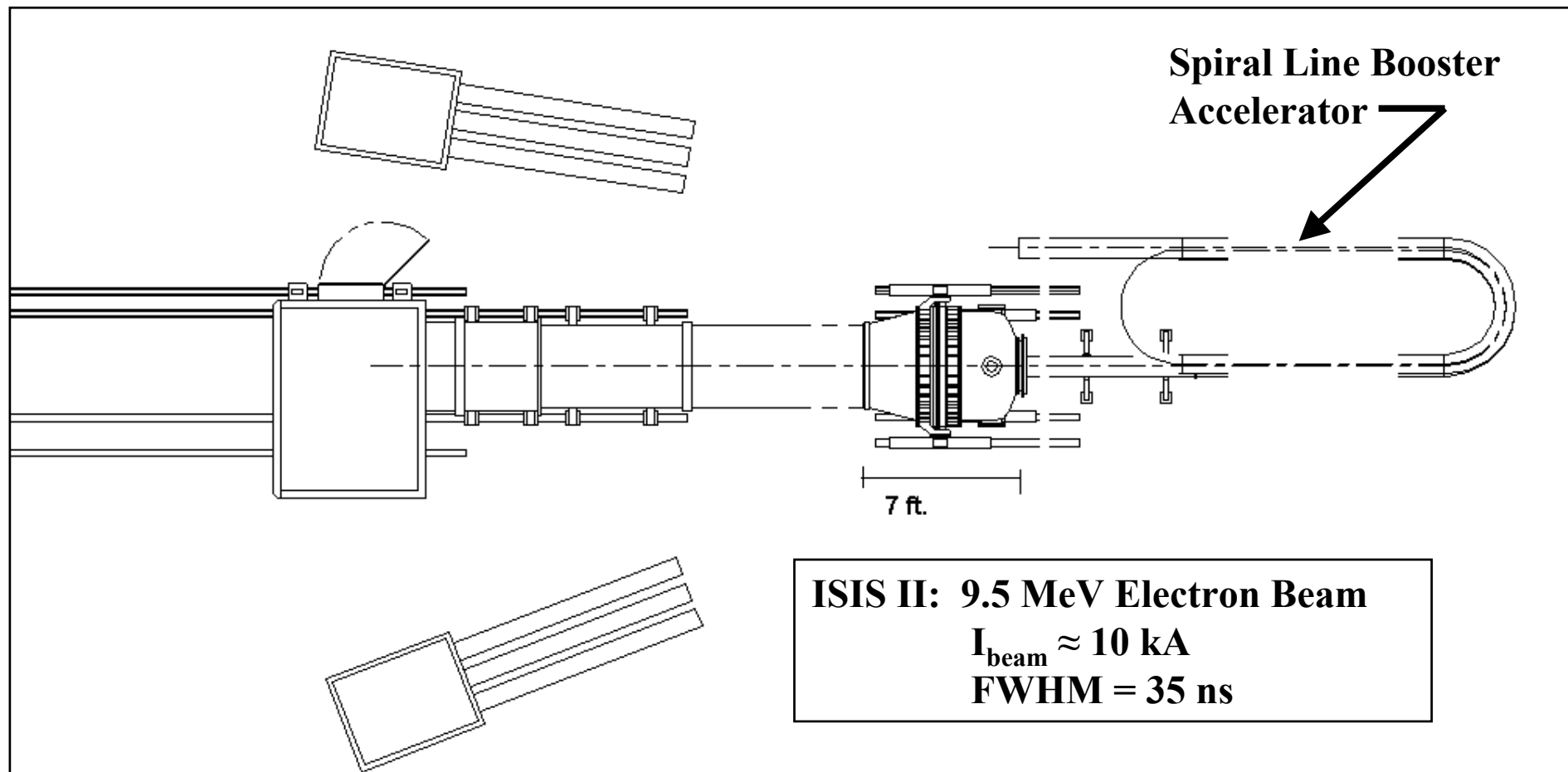
**FWHM = 35ns**

**Beam Diameter  $\approx 1.0 \text{ cm}$**





# ISIS II (Idaho State Induction Acceleration System II)



# Other Beam Capabilities:

## x-rays and $\gamma$ -rays

Intense X-ray/ $\gamma$ -ray beams from electron beams colliding with high-Z targets (tungsten)

➔ bremsstrahlung beams

➔ continuous spectrum of x-ray energies up to electron energy.

(“useful” x-rays ( $> 1$  MeV)  $\sim 10^{14} - 10^{15}/\text{sec}$ )



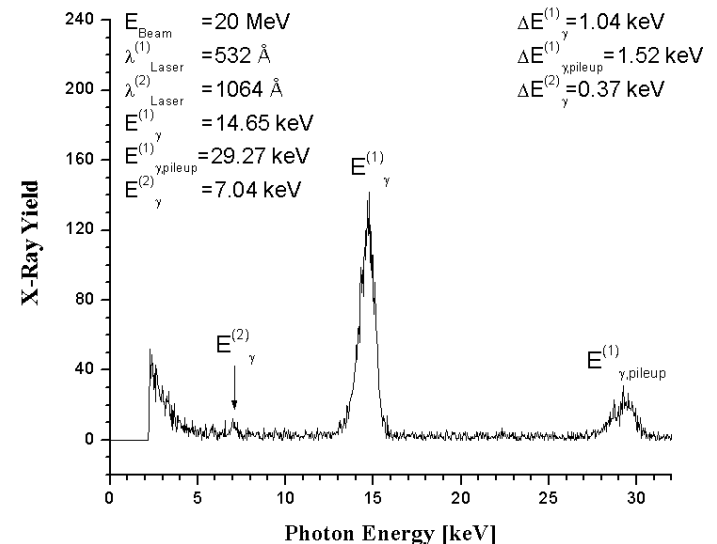
# Other Beam Capabilities:

## Neutrons

- Neutron beams from photonuclear source can produce  $\approx 10^{12}$  neutrons/sec with  $\sim$  fission spectrum.
- An accelerator source with  $> 10^{13}$  n/s under construction.
- With re-commissioned 3 MW electron linac, can produce  $\sim 10^{15}$  neutrons/sec

# Other Beam Capabilities: Novel Beams

- Compton Back-scattered mono-chromatic X-rays, 5keV to 30 keV.
- X-ray radiation from the interaction of relativistic electron beams with periodic structures (i.e. crystals).



# Conclusions:

The IAC has an extraordinary array of accelerators and radiation beams:

- The IAC produces every (common) type of radiation beam over a wide range of dose rates, energies, etc.